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SMALL GRAIN CROPS IN ALABAMA

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Small Grain Crops in Alabama

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INTEREST in small grain crops in Alabama is increasing due to the decline in the price of farm products, which emphasizes the need for producing feed and food crops at home. Cheap cotton and reduced purchasing power make it absolutely necessary that feed for livestock be produced economically on the farm. The low price of poultry and dairy products has forced the producers of these commodities to become interested in growing a larger percentage of their feed in order to lower production costs and meet competition. The dry summers and uneven distribution of rainfall in recent years have made the production of corn and other summer feed crops so difficult that the attention of farmers has turned to the small grain crops.

This circular gives the results of experiments conducted at this station showing the effect of time and methods of planting on yields of oats, the effect of fertilizers on yields of oats, and the relative productiveness of different varieties of oats, wheat, and rye. Harvesting, uses, and diseases of small grain crops are also discussed.

PLANTING

Methods of Seeding Oats.—Different methods of seeding oats were studied on the station farm at Auburn during the seven-year period, 1921 to 1927, inclusive. The methods used included broadcast and drilled planting on land broken with a one-horse plow, on land broken with a two-horse plow, and on unbroken land. All plots in the experiment were fertilized alike. The results of this experiment are presented in Table 1.

Table 1.—Influence of Different Methods of Seeding on Yields of Oats.

Plot No.	Method of seeding	Six-year average yield 1921-1927*
		Bus. per acre
1	Land not plowed; seed disked in	40.5
2	Land not plowed; seed drilled with one-horse drill	40.2
3	Seed sown and plowed in with one-horse plow	47.6
4	Land broken with two-horse plow; seed sown and disked in	48.6
5	Land broken with two-horse plow; seed drilled with one-horse drill	47.5

*The crop of 1924 was killed by cold and was not included in the average. Each plot received an average of 116 pounds of nitrate of soda per acre annually.

The average yields show that plowing the land increased the yield of oats approximately seven bushels per acre. There was practically no difference in the yield from deep breaking with a two-horse plow and shallow breaking with a one-horse plow. Oats in this experiment planted in drills and those planted broadcast produced approximately the same yield. This indicates that when the weather was cold enough to kill oats planted broadcast those in drills were also killed.

In another experiment methods and dates of seeding were studied. The purpose of this experiment was to determine whether planting should be delayed in the fall until the land could be plowed, or whether it should be done early without plowing. Another purpose was to learn whether or not plowing would increase the yield enough to be profitable. The details of this experiment and the average yields are shown in Table 2.

Table 2.—Effect of Different Methods and Dates of Seeding on Yields of Oats*.

Plot No.	Method of seeding	Date of seeding	Four-year average yield 1928-1931
			Bus. per acre
1	Land turned; seed sown and disked in	Oct. 15	39.6
2	Land not broken; seed sown and disked in	" "	34.0
3	Land not broken; seed drilled with one-horse drill	" "	33.1
4	Land turned; seed sown and disked in	Nov. 15	31.0
5	Land not broken; seed sown and disked in	" "	28.7
6	Land broken; seed drilled with one-horse drill	" "	24.7

*Each plot received 200 pounds of nitrate of soda per acre.

The results of this experiment show that plots which were broken made from 3 to 6 bushels of oats per acre more than the unbroken plots planted on the same date. However, unbroken plots planted October 15 produced more oats than broken plots planted November 15. These results show the advisability of drilling oats in cotton middles before picking is finished rather than delay planting until the cotton is picked in order to break the land. This method of planting allows the time that would be spent in breaking land to be used in planting, thus making it possible to plant a larger acreage to oats. This increased acreage, together with the larger yield resulting from early planting, is of more importance than the increase in yield due to breaking.

A Comparison of Fall and Spring Planting of Oats.—In an experiment at Auburn oats planted in the fall were compared with those planted in the spring during the 29-year period, 1896 to 1924, inclusive. During this period the yields of 20 crops of fall-planted oats and 21 crops planted in the spring were record-

ed; the records of the other crops were lost in the fire of October, 1920. The results of this experiment are shown in Table 3.

Table 3.—Comparative Yields from Spring and Fall Planting of Oats*.

Year	Fall	Spring	Year	Fall	Spring
	Bus.	Bus.		Bus.	Bus.
1896	21.5	13.0	1911	56.9	31.5
1897	21.7	13.8	1912	57.7	10.9
1898	18.2	6.4	1913	48.5	12.1
1899	23.8	14.1	1914	53.1	34.6
1903	27.2	13.7	1915	40.1	5.3
1904	15.9	13.3	1920	24.2	9.7
1905	26.9	32.0	1921	44.1	47.1
1906	53.8	15.0	1922	31.5	3.9
1908	34.5	7.0	1923	31.8	9.7
1909	36.2	13.8	1924	0**	18.0
1910	49.1	31.2	Average	34.1	17.0

*Fall and spring plantings were fertilized with 100 pounds of nitrate of soda per acre.
**Killed by cold.

The average results show that the yield from oats planted in the fall was twice as large as that from spring planting. In only two years, 1905 and 1921, was the yield larger from spring than from fall planting. The results of this experiment show in a striking way the importance of planting oats in the fall. Only in sections where fall-planted oats are usually killed by cold should planting be delayed until spring.

Time of Planting Wheat and Rye.—Wheat should be planted from October 15 to November 1 in Alabama. Plantings made in December at Auburn have made moderately large yields some years. However, it is advisable to plant earlier so that plants may be well rooted before cold weather begins.

Rye is usually planted for grazing and, therefore, should be sown as early in the fall as possible. If planted as early in September as there is enough moisture to get a stand, rye will make enough growth to furnish some grazing before Christmas. On the other hand, if planting is delayed until late in the fall, little grazing may be expected before late winter or early spring.

Rate of Seeding.—Oats should be seeded at the rate of two to three bushels per acre. In sections where freeze injury might occur the rate should be about three bushels per acre, whereas two bushels are enough where there is little probability of the stand being thinned by cold. Wheat and rye should be sown at the rate of four to six pecks of seed per acre.

FERTILIZATION

Effect of Phosphate and Potash on Small Grains.—No studies have been made at this station to determine the direct effect of phosphate or potash on the small grain crops. However, the results of experiments which included oats in the cropping system indicate that if the small grains are grown after cotton or other crops fertilized with phosphate and potash it will not be profitable to apply either of these materials for the grain crops.

Sources and Rates of Application of Nitrogen for Oats.—The influence of various sources of nitrogen on the yield of oats was studied in an experiment on Norfolk sandy loam soil at Auburn during the five-year period, 1927 to 1931, inclusive. This experiment also included plots on which different amounts of nitrate of soda were used. The different sources of nitrogen were compared on the basis of 30 pounds of nitrogen (equivalent to 200 pounds of nitrate of soda) per acre. The details of the experiment and the average yields are given in Table 4.

Table 4.—Influence of Different Sources and Rates of Application of Nitrogen on Yields of Oats.

Plot No.	Nitrogenous fertilizer.* Pounds per acre	Bushels of oats per acre	
		Five-year average 1927-1931	Increase over average of check plots
1, 5, 9, and 13	None	7.7	
2	100 Nitrate of soda	18.5	10.8
3	200 Nitrate of soda	28.2	20.5
4	300 Nitrate of soda	37.9	30.2
6	400 Nitrate of soda	41.4	33.7
7	500 Nitrate of soda	46.0	38.3
8	150 Ammonium sulfate	30.2	22.5
10	200 Calcium nitrate	27.6	19.9
11	67.4 Urea	29.5	21.8
12	124 Leunasalpeter	29.3	21.6

*All plots received 400 pounds of superphosphate and 50 pounds of muriate of potash per acre.

The data in Table 4 show that the plot on which ammonium sulfate was used made the largest yield. The other sources yielded in the following order: urea, leunasalpeter, nitrate of soda, and calcium nitrate. However, there was a difference of only 2.6 bushels per acre between the yields from ammonium sulfate and calcium nitrate. Ammonium sulfate, urea, and leunasalpeter are acid-forming fertilizers and if used on land without lime for a period of time, which will vary with the type of soil, will increase the acidity (sourness) to a degree that is harmful to most farm crops. If these materials are used on lime land, or with enough lime to correct the acidity formed, they are satisfactory.

Figure 1.—Oats without fertilizer made 18.4 bushels per acre. (Plot 7 Cullars Rotation Experiment. Photographed May 9, 1923.)

The amount of ground limestone required to correct the acidity from 100 pounds of each of these materials is as follows: ammonium sulfate, 120 pounds; urea, 133 pounds; and leunasalpeter, 113 pounds.

Extremely heavy rains which occurred the day after the nitrogenous fertilizers were applied in 1929 caused heavy losses from leaching in this experiment. Nitrate of soda and calcium nitrate are more readily leached than the other sources of nitrogen and, consequently, suffered a more serious loss.

Average yields of Plots 2, 3, 4, 6, and 7 in Table 4 show that the addition of each hundred pounds of nitrate of soda, up to and including 300 pounds per acre, resulted in an increase of approximately 10 bushels of oats per acre. Although there were some increases in yields for applications above 300 pounds, these increases were too small to be profitable. These data do not justify a recommendation of more than 300 pounds of nitrate of soda, or its equivalent, per acre on sandy soil. The heavier applications resulted in some lodging and it is probable that on rich land this would have been severe enough to cause a material reduction in yield.

The average yields in this experiment were reduced by rust in 1929 and by unusually dry weather in the spring of 1930. The yields were also smaller than they would have been on richer

Figure 2.—Oats fertilized with 100 pounds of nitrate of soda per acre made 38.4 bushels per acre. (Plot 8 Cullars Rotation Experiment. Photographed May 9, 1923.)

land; the area used is less productive than average Norfolk soil.

Although no experiments have been conducted at this station to study the fertilizer needs of wheat and rye, they are closely related to oats and, therefore, would probably give about the same response to fertilizers.

VARIETIES

Varieties of Oats.—The average yields of oats produced in the variety test at Auburn are shown in Table 5. All varieties included in the test were fertilized with 400 pounds of superphosphate and 50 pounds of muriate of potash in the fall. A top dressing of 200 pounds of nitrate of soda per acre was applied about March 1.

Table 5.—Yields of Oats in Variety Test

Variety	Bushels of oats per acre	
	Three-year average* 1929-1931	Eight-year average** 1922-1931
Red Rustproof	35.3	41.6
Fulghum	38.0	40.9
Appler	30.7	39.5
Norton	37.5	

*All varieties were injured by rust in 1929 and by drouth in 1930.
**The crops of 1924 and 1928 were killed by cold and are not included in the averages.

Figure 3.—Oats fertilized with 468 pounds of nitrate of soda per acre made 68.4 bushels per acre. (Plot 3 Cullars Rotation Experiment. Photographed May 9, 1923.)

There was little difference in the yields of the Red Rustproof, Fulghum, and Appler varieties during the period from 1922 to 1931, inclusive.

The average yields for the three-year period, 1929 to 1931, inclusive, are shown for the purpose of giving a comparison of Norton, a comparatively new variety, with standard varieties which are generally grown in Alabama. It may be seen that Norton made about as large yield as the other varieties tested. This variety is more cold resistant than Fulghum or the Red Rustproof varieties; it withstood a temperature of 8° F. in January, 1928 when other varieties were almost completely killed. It is probably more susceptible to rust than the Red Rustproof and Fulghum varieties. The ripening date for Norton is about one week later than that of Fulghum. This is a promising variety for North Alabama where cold resistance is desired.

Varieties of Wheat.—Six varieties of wheat were tested at Auburn during the three-year period, 1921 to 1923, inclusive. Each variety was fertilized uniformly with phosphate and potash in the fall and with 100 pounds of nitrate of soda per acre about March 1. The average yields are given in Table 6.

Figure 4.—Alabama Bluestem wheat at Auburn which made 42 bushels per acre. (Photographed May 7, 1931.)

Table 6.—Yields of Wheat in Variety Test

Variety	Three-year average yield 1921-1923
	Bus. per acre
Alabama Bluestem	18.1
Currell	13.2
Dietz	12.1
Stover	12.0
Fulcaster	11.7
Leap's Prolific	8.6

It may be seen from Table 6 that Alabama Bluestem was the leading variety tested. This variety produced 37 per cent more wheat than Currell which was the second-highest-yielding variety. Alabama Bluestem is less susceptible to rust than any of the other varieties tested and is a more consistent yielder.

Although the average yield of wheat made by the highest-producing variety was only 18.1 bushels per acre, it was only 3 bushels less than the yield of corn made on the same type of soil with similar fertilizer treatment during this period.

Varieties of Rye.—Five varieties of rye were tested at Auburn. This test was conducted on deep sand which was not adapted to grain crops. Each variety was fertilized with phosphate and potash in the fall and 100 pounds of nitrate of soda per acre about March 1, except in 1920 when no fertilizer was used. The average yields are given in Table 7.

Table 7.—Yields of Rye in Variety Test

Variety	Four-year average yield 1920-1923
	Bus. per acre
Tuscaloosa	7.6
Abruzzi	7.5
Florida	6.4
Rosen	5.7

Abruzzi and Tuscaloosa, a local variety, made more rye than any of the other varieties used. Abruzzi grows faster in the fall than other varieties and is probably the most suitable for fall and winter grazing. It also matures seed early in the spring and is probably the most satisfactory variety for general use in Alabama.

HARVESTING

Time of Harvesting.—If small grain crops are to be harvested for grain they should be allowed to become practically ripe. The straw should be ripe and the grain nearly dry before harvesting begins. On the other hand, if oats are to be fed in the straw they should be cut while the grain is in the dough stage. If cut at this stage some of the straw is still green and will be eaten more readily by animals than if left until thoroughly ripe before harvesting.

Enough of each small grain crop grown should be harvested for seed to supply the needs of the farm. Seed can usually be harvested cheaper on the farm than it can be bought. In addition to costing less money, seed produced at home is of known variety, whereas that bought on the market may not be true to name.

Methods of Harvesting.—In case a large acreage of grain is grown, it may be harvested and threshed with a combine. Most of the grain threshed with combines in Alabama is cut and allowed to lie in the swath until dry, after which it is raked and threshed from the windrow.

Smaller plantings are usually cut with a binder. The bundled grain is shocked in the field until dry enough to thresh. Figure 5 shows a six-foot binder which will cut about ten acres of grain

Figure 5.—Cutting wheat at Auburn with a six-foot binder. A machine like this should cut about ten acres of grain per day. (Photographed June 1, 1931.)

per day. A binder of this size is too heavy for two mules and should be drawn by three or four if a full day's cutting is to be done.

Another method of harvesting is with a mower equipped with a bunching attachment. By this method the grain is left in bunches which may be tied by hand. Although this method of harvesting requires more labor than cutting with a binder, it may be desirable in case the acreage grown is too small to justify buying a binder.

Small areas may be cut with a cradle, but this method is slow and should be used only where none of the methods discussed above can be used.

In case oats are to be fed in the straw they should be cut with a mower and handled like hay. They may be stored as soon as dry, either loose or baled.

SMALL GRAIN CROPS FOR HAY AND GRAZING

Hay.—Mixtures composed of one of the small grain crops and either hairy vetch or Austrian winter peas are being used extensively in Alabama for hay. Such a mixture usually makes a larger yield than any of the spring-planted hay crops used in the state. This crop may be harvested early enough in the spring to allow another hay crop to be planted on the land, thus making two crops of hay a year from the same land. Mixtures of grain and legumes have made more hay in experiments than either crop planted alone.

Oats should be planted for hay except in sections where there is danger of winter killing, in which case wheat or rye may be used. Planting should be done during the latter half of September or the first half of October.

Oats and legumes should be cut for hay when oats are in the early dough stage. When wheat or rye is used in mixtures, harvesting should be done as soon as the grain is headed. The danger of loss from rust increases as the wheat approaches maturity. If either wheat or rye is allowed to stand until the straw is ripe the hay will lose in both palatability and digestibility.

Hay and grain should be well cured before being stored. Partially cured hay or grain stored in bulk may heat to the extent that the barn in which it is stored will be set on fire and destroyed.

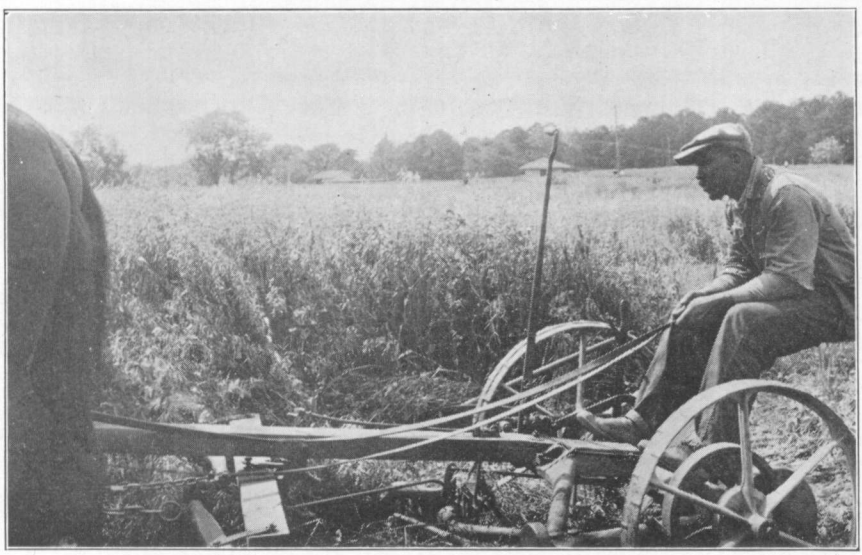

Figure 6.—Mowing oats and Austrian winter peas which made two and one-half tons of hay per acre. (Photographed May 7, 1931.)

Grazing.—Oats, wheat, or rye may be planted early in the fall and grazed by livestock during the winter. Oats and rye grow more rapidly during the early fall and will supply winter pasturage. In North Alabama where oats may be killed by cold, it is advisable to use rye. Abruzzi rye grows rapidly in the fall and early winter and is probably the most satisfactory variety for grazing. An experiment was started at this station in the fall of 1930 to determine the value of the small grain crops for grazing, but this problem must be studied further before any conclusions can be drawn.

DISEASES OF SMALL GRAINS

There are a number of fungous and bacterial diseases of small grains. These diseases are relatively unimportant in Alabama except on oats and wheat. These plants suffer material losses from the smuts and rusts, which cause more than 90 percent of the total plant disease losses to these crops annually.

Oat Smuts.—Oat smut destroyed a very high percentage of the oats grown in Alabama during the past season (1930-31). In a number of oat fields there was noted as much as 30 to 40 percent of smutted heads; this is an unwarranted loss, as the disease can be controlled very easily and cheaply by treating the oat seed before planting.

There are two smuts quite similar in character and controlled by the same methods. They are confined to the oat plant and do not attack the other small grains. Each black dust-like mass formed on the oat head is composed of millions of spores of the fungus. Spores are to the fungus just what seed are to the oat plant. The smutted heads show up before the healthy ones, and the matured spores are blown by the wind to the healthy heads. By this means and through threshing operations the spores are spread to the seed. Unfortunately, there is no accurate way of telling when the seed is infected; but as a general rule, most oat seed carries some smut and, therefore, should be treated.

Under and on the seed coat, the spores, and delicate thread-like growths from them, are carried until the seed is planted. When the seed germinates the fungus grows into the seedling before it comes out of the ground. The fungus is not evident in the plant and a diseased plant is not noted until heading time, when black masses, which are formed into spores, appear where the flowers should appear. Soil moisture and temperature at planting time often determine the amount of smut that will appear in the spring, more or less, regardless of the number of spores carried on the seed oats. Favorable climatic conditions cannot be depended upon to control smut, and it is therefore much safer to treat the seed before planting. When seed oats

are treated properly with formaldehyde solution, practically all smut organisms are killed.

The cost of treating seed oats with formaldehyde solution should not be over a few cents a bushel, regardless of the number of bushels to be treated.

Directions for Treating Oats

1.—Buy a one-quart atomizer-type sprayer from a drug or hardware store. (Cost about 50 cents.)
2.—Get from a drug store one pint of formaldehyde (40 percent) solution for each 50 bushels of seed to be treated. (Cost about 50 cents).
3.—Pile oats to be treated on a clean floor, canvas, or in a tight wagon bed.
4.—Pour formaldehyde from the bottle into the sprayer; fill the bottle with water and pour it into the sprayer.
5.—While the oats are being shoveled from one pile to another, give one good squirt of the solution to each shovel full of oats as they are moved.
6.—Round up the treated pile of oats and cover with bags which have been sprayed inside and out with the solution in order that the formaldehyde gas may be retained and penetrate the entire pile.
7.—Leave the oats covered five hours, or over night.

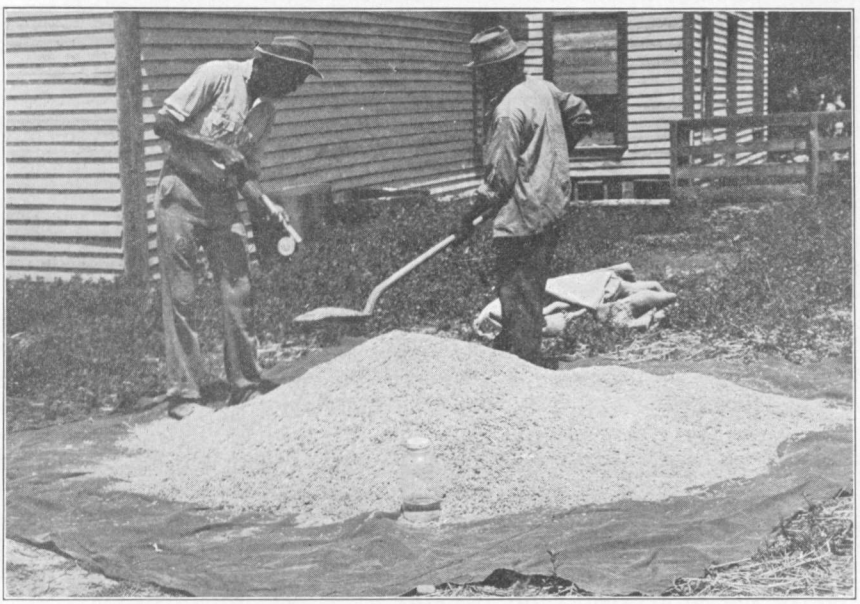

Figure 7.—Oats being treated with formaldehyde to prevent smut.

Oats treated by this method do not swell and will readily run through the grain drill, even the same day they are treated. Since there is not sufficient liquid used to wet the oats, they may be treated weeks or months before they are to be sown and their germinating power remain uninjured. Treated seed, after airing for a few days, may be fed with safety to livestock. The only disagreeable feature of this method is that formaldehyde gas irritates the eyes and nasal membranes of the handlers unless the seed is treated in the open or in a place where there is cross ventilation.

Oat Rusts.—There are two rusts found commonly on oats in this state. Black stem rust appears on the stems, leaves and glumes, where it causes pustules that are from 1/16 to ¼ inch in length. In the red stage the pustules are brick red and often granular in appearance, but later these same pustules turn black. The other rust is known as crown rust or leaf rust. This is the most common and destructive rust in Alabama. The pustules on the stems, leaves, and glumes are often much smaller than stem rust, frequently about one-half the size. In the red stage the pustules are orange yellow in color and often waxy and smooth in general appearance, but later turn black, as in the other rust.

Both rusts have many grass hosts. Here in the South, they live from year to year on grains and grasses. The warm dry summers and cold winters are unfavorable for the growth of these fungi, but they are able to persist and develop rapidly when seasonal conditions become favorable. The only known means of reducing damage from the rusts consists in the use of the more resistant varieties, such as Red Rustproof or Fulghum.

Wheat Rusts.—Just as in the case of the oat plant, there are two rusts attacking the wheat plant; stem rust, which is caused by the same fungus that causes stem rust of oats; and leaf rust, which is caused by a different organism. The latter will not go from wheat to oats. Nothing can be done at the present for the control of these wheat rusts in the South, unless resistant varieties are found.

Wheat Smuts.—There are three smuts of wheat, two known as stinking smut, and one as loose smut. The two stinking smuts are essentially alike and may be treated as one smut. This smut is not commonly noted before the wheat heads. The diseased heads are frequently distorted or abnormal in shape. The smut balls, which replace the wheat seed, become large enough to spread apart the glumes or chaff. When one of these smut balls is broken open it is found to be a mass of black, powdery spores. These smut balls have a disagreeable odor resembling that of decaying fish; thus the name "stinking smut".

During harvesting and threshing, many of the smut masses are broken and the spores are spread to the healthy seed. The

spores stick to the surface of the sound seed and when the seed is planted the spores germinate as the wheat germinates. The minute germ tube of the smut enters the wheat seedling and grows along with the growing plant until heading time, when the fungus forms the smut ball in place of the normal wheat seed. Since the spores of this smut are carried on the surface of the seed, various types of seed disinfectants have been used to kill them. Copper carbonate is a very finely-ground dust as manufactured for seed treatment and is used at the rate of 2 to 2½ ounces to each bushel of seed. Effective treatment requires that each seed be coated with the dust. The best way to obtain a thorough application of the dust is to treat the seed in some kind of rotating machine, barrel mixer, or barrel churn. In dusting seed the operator should wear a mask or a wet handkerchief over his nose and mouth, as the inhaled dust will cause irritation and even nausea. Copper carbonate dust is rather generally recommended in the North, West, and Northwest. Formaldehyde solution, used as in the control of oat smut, is effective but frequently injures the seed and therefore is not recommended. The hot water treatment, used for the control of loose smut, is effective; however, it is not generally used unless loose smut is also present.

Loose smut in many respects is quite similar to the oat smuts. The diseased heads are completely destroyed and in the place of seed and chaff only smut masses are formed. These diseased heads frequently appear before the healthy heads. The spores mature and are carried by the wind, insects, and other agencies to the flowering healthy plants. Here they lodge in the flowers, germinate and send their germ tubes into the young seed kernel. The seed is not destroyed, but the fungus remains dormant within the seed. Infected seed show no external evidence of being diseased. However, in case the infected seed is planted without treatment, the smut fungus begins to grow along with the seedling plants and makes its appearance at heading time.

The only effective control known is the hot water treatment. The principle involved is to kill the fungus within the seed without injury to the seed. This method of treatment is difficult for the average farmer to use. As a general rule, farmers will find that treating small batches of seed by this method and using them for planting seed patches is most profitable. These seed patches should not be near other wheat.

Directions for treatment are as follows:

1.—Fill a bag half full of seed and tie the top of the bag.

2.—Soak the seed for four hours in cold water.

3.—Have two large tubs of water heated, one to 120° F. and the other to 129° F.

4.—Dip the soaked seed in the tub of water at 120° F. for a few minutes, then place in the second tub of water at 129° F. for 10 minutes. The water in the second tub must be held near 129° F., for if it falls much below this temp-

erature the smut will not be killed, and if it rises several degrees above this the seed will be killed.

5.—After the seed is treated it should be spread out in a thin layer and thoroughly dried. When the seed has dried it may be planted.

SUMMARY

1.—Plowing the land before oats were planted increased the yield approximately seven bushels per acre.

2.—Oats planted in drills and those planted broadcast made practically the same yield.

3.—Drilling did not materially reduce the injury to oats by cold.

4.—Oats drilled in cotton middles without plowing on October 15 made more than those planted one month later on land which was plowed.

5.—The average yield of fall-planted oats was double that of those planted in the spring in a long-time experiment at Auburn.

6.—Wheat should be planted from October 15 to November 1.

7.—Rye for grazing should be planted after the first rain in September.

8.—Oats should be planted at the rate of 2 to 3 bushels per acre.

9.—Wheat or rye should be sown at the rate of 4 to 6 pecks per acre.

10.—There was a difference of only 2.6 bushels of oats per acre between the yields produced by ammonium sulfate and calcium nitrate, which made the high and low yields, respectively, in a source-of-nitrogen test that included nitrate of soda, ammonium sulfate, calcium nitrate, urea, and leunasalpeter.

11.—Each hundred pounds of nitrate of soda, up to and including 300 pounds per acre, made approximately 10 bushels of oats.

12.—Red Rustproof, Fulghum, and Appler oats made approximately the same average yields during the period from 1922 to 1931, inclusive.

13.—Norton, a cold-resistant variety, compared favorably with other varieties in yield during the three-year period, 1929-1931, inclusive.

14.—Alabama Bluestem was the highest-yielding variety of wheat in tests at Auburn.

15.—Abruzzi grows faster in the fall than other varieties of rye and is probably the most satisfactory variety for winter grazing.

16.—Small grains should be practically ripe before being harvested for grain.

17.—Enough seed of each small grain crop should be harvested to supply the needs of the farm.

18.—Mixtures composed of one of the small grains and either hairy vetch or Austrian winter peas usually make larger yields of hay than spring-planted hay crops.

19.—Oats and legumes should be cut for hay when the grain is in the dough stage; wheat or rye and legumes when the grain is headed.

20.—Hay and grain should be dry before being stored. Damp hay or grain stored in bulk may heat and set the barn on fire.

21.—Rye is more satisfactory for winter grazing than either wheat or oats.

22.—Smuts and rusts are the most destructive diseases of small grain crops in the South.

23.—Oat smuts are controlled by treating the seed before planting with formaldehyde solution. The spray method is recommended.

24.—The only practical control measure for rusts of oats is the use of rust-resistant varieties, as Red Rustproof or Fulghum.

25.—Stinking smut of wheat is controlled by copper carbonate dust.

26.—Loose smut of wheat is controlled by treating the seed wheat with hot water at 129° F. for 10 minutes.